

CPC**COOPERATIVE PATENT CLASSIFICATION****F02F**

CYLINDERS, PISTONS OR CASINGS, FOR COMBUSTION ENGINES; ARRANGEMENTS OF SEALINGS IN COMBUSTION ENGINES (specially adapted for rotary-piston or oscillating-piston internal-combustion engines [F02B](#); specially adapted for gas-turbine plants [F02C](#); specially adapted for jet-propulsion plants [F02K](#))

NOTE

Attention is drawn to the notes preceding class [F01](#).

In considering the relationship between class [F16](#) and subclass [F02F](#), class [F16](#) will take precedence unless the subject-matter is specific to combustion engines.

F02F 1/00

Cylinders; Cylinder heads (in general [F16J](#))

F02F 1/002

. {Integrally formed cylinders and cylinder heads}

F02F 1/004

. { Cylinder liners ([F02F 1/08](#), [F02F 1/16](#) take precedence)}

F02F 1/02

. having cooling means (cylinder heads [F02F 1/26](#))

F02F 1/04

.. for air cooling

F02F 1/045

... [N. Attachment of cylinders to crankcase]

F02F 1/06

... Shape or arrangement of cooling fins; Finned cylinders

F02F 1/065

.... {with means for directing or distributing cooling medium}

F02F 1/08

.... running-liner and cooling-part of cylinder being different parts or of different material

F02F 1/10

.. for liquid cooling

F02F 1/102

... {Attachment of cylinders to crankcase}

F02F 1/108

... {Siamese-type cylinders, i.e. cylinders cast together}

F02F 1/12

... Preventing corrosion of liquid-swept surfaces

F02F 1/14

... Cylinders with means for directing, guiding or distributing liquid stream

F02F 1/16

... Cylinder liners of wet type

F02F 1/163

.... {the liner being midsupported}

F02F 1/166

.... {Spacer decks}

F02F 1/18

. Other cylinders

F02F 1/183

.. {Oval or square cylinders}

F02F 1/186

.. {for use in engines with two or more pistons reciprocating within same cylinder (such engines per se [F02B 75/28](#))}

F02F 1/20

.. characterised by constructional features providing for lubrication

F02F 1/22

.. characterised by having ports in cylinder wall for scavenging or charging

- F02F 1/24 . Cylinder heads
- F02F 1/242 .. {Arrangement of spark plugs or injectors}
- F02F 1/243 .. {Cylinder heads and inlet or exhaust manifolds integrally cast together}
- F02F 1/26 .. having cooling means
- F02F 1/28 ... for air cooling
- F02F 1/30 Finned cylinder heads
- F02F 1/305 {the cylinder heads being of side valve type}
- F02F 1/32 the cylinder heads being of overhead valve type
- F02F 1/34 with means for directing or distributing cooling medium ([F02F 1/32](#) takes precedence)
- F02F 1/36 ... for liquid cooling
- F02F 1/365 {the cylinder heads being of side valve type}
- F02F 1/38 the cylinder heads being of overhead valve type
- F02F 1/40 Cylinder heads with means for directing, guiding, or distributing liquid stream ([F02F 1/38](#) takes precedence)
- F02F 1/42 .. Shape or arrangement of intake or exhaust channels in cylinder heads
- F02F 1/4214 ... {specially adapted for four or more valves per cylinder}
- F02F 1/4221 {particularly for three or more inlet valves (mechanisms for driving such valves [F01L 1/265](#))}
- F02F 1/4228 ... { Helicallly-shaped channels}([F02B 31/00](#) takes precedence)]
- F02F 1/4235 ... { of intake channels}
- F02F 1/4242 { with a partition wall inside the channel}
- F02F 1/425 { with a separate deviation element inside the channel}
- F02F 1/4257 { with an intake liner}
- F02F 1/4264 ... { of exhaust channels}
- F02F 1/4271 { with an exhaust liner}
- F02F 1/4285 ... { of both intake and exhaust channel}
- F02F 1/4292 { with liners ([F02F 1/4257](#), [F02F 1/4271](#) take precedence)}

F02F 3/00 **Pistons** (in general [F16J](#))

- F02F 3/0015 . {Multi-part pistons}
- F02F 3/0023 .. {the parts being bolted or screwed together}
- F02F 3/003 .. {the parts being connected by casting, brazing, welding or clamping}
- F02F 3/0069 .. {the crown and skirt being interconnected by the gudgeon pin}
- F02F 3/0076 . {the inside of the pistons being provided with ribs or fins}
- F02F 3/0084 . {the pistons being constructed from specific materials}
- F02F 3/0092 .. {the material being steel-plate}
- F02F 3/02 . having means for accomodating or controlling heat expansion
- F02F 3/022 .. {the pistons having an oval circumference or non-cylindrical shaped skirts, e.g. oval ([F02F 3/025](#), [F02F 3/027](#) take precedence)}

- F02F 3/025 . . {having circumferentially slotted piston skirts, e.g. T-slots}
- F02F 3/027 . . {the skirt wall having cavities}
- F02F 3/04 . . having expansion-controlling inserts
- F02F 3/042 . . . {the inserts consisting of reinforcements in the skirt interconnecting separate wall parts, e.g. rods or strips}
- F02F 3/045 . . . {the inserts being located in the crown}
- F02F 3/047 . . . {the inserts being located around the gudgeon pin bearings}
- F02F 3/06 . . . the inserts having bimetallic effect
- F02F 3/08 . . . the inserts being ring-shaped

- F02F 3/10 . having surface coverings ([F02F 3/02](#) takes precedence)
- F02F 3/105 . . {the coverings forming a double skirt}
- F02F 3/12 . . on piston heads
- F02F 3/14 . . . within combustion chambers

- F02F 3/16 . having cooling means
- F02F 3/18 . . the means being a liquid or solid coolant, e.g. sodium, in a closed chamber in piston
- F02F 3/20 . . the means being a fluid flowing through or along piston
- F02F 3/22 . . . the fluid being liquid
- F02F 3/225 {the liquid being directed into blind holes}

- F02F 3/24 . having means for guiding gases in cylinders, e.g. for guiding scavenging charge in two-stroke engines

- F02F 3/26 . having combustion chamber in piston head ([the surface thereof being covered F02F 3/14](#))

- F02F 3/28 . Other pistons with specially-shaped head
- F02F 3/285 . . {the head being provided with an insert located in or on the combustion-gas-swept surface}

- F02F 5/00** **Piston rings, e.g. associated with piston crown** {not used see [F16J 9/00](#)}

- F02F 7/00** **Casings, e.g. crankcases** ([engine casings in general F16M](#)){or frames}

- F02F 7/0002 . {Cylinder arrangements}
- F02F 7/0004 . . {Crankcases of one-cylinder engines}
- F02F 7/0007 . . {Crankcases of engines with cylinders in line}
- F02F 7/0009 . . {Crankcases of opposed piston engines}
- F02F 7/0012 . . {Crankcases of V-engines}
- F02F 7/0014 . . {Crankcases of W-, deldic, or quadratic engines, or the like}
- F02F 7/0017 . . {Crankcases of radial engines}
- F02F 7/0019 . . {Cylinders and crankshaft not in one plane (deaxation)}

- F02F 7/0021 . {Construction}
- F02F 7/0024 .. {Casings for larger engines}
- F02F 7/0026 ... {Casings for horizontal engines}
- F02F 7/0029 .. {Space-frames}
- F02F 7/0031 .. {Construction kit principle (modular engines)}
- F02F 7/0034 .. {Built from sheet material and welded casings}
- F02F 7/0036 .. {Casings for two-stroke engines with scavenging conduits}
- F02F 7/0039 .. {Casings for small engines, especially with crankcase pumps}

- F02F 7/0043 . {Arrangements of mechanical drive elements}
- F02F 7/0046 .. {Shape of casings adapted to facilitate fitting or dismantling of engine parts}
- F02F 7/0048 .. {Tunnel-type frames}
- F02F 7/0051 .. {Crankcase pump engines}
- F02F 7/0053 .. {Crankshaft bearings fitted in the crankcase}
- F02F 7/0058 .. {Longitudinally or transversely separable crankcases}

- F02F 7/006 . {Camshaft or pushrod housings (oil sumps [F01M 11/0004](#))}

- F02F 7/0065 . {Shape of casings for other machine parts and purposes, e.g. utilisation purposes, safety}
- F02F 7/0068 .. {Adaptations for other accessories}
- F02F 7/007 .. {Adaptations for cooling}
- F02F 7/0073 .. {Adaptations for fitting the engine, e.g. front-plates or bell-housings}
- F02F 7/008 .. {Sound insulation (see also [F02B 77/13](#))}

- F02F 7/0082 . {Mounting of engine casings}

- F02F 7/0085 . {Materials for constructing engines or their parts}
- F02F 7/0087 .. {Ceramic materials}

- F02F 7/0095 . {Constructing engine casings (welded casings [F02F 7/0034](#))}

- F02F 11/00** **Arrangements of sealings in combustion engines** (piston rings [F02F 5/00](#){not used, see [F16J 9/00](#)}; sealings per se [F16J](#))

- F02F 11/002 . {involving cylinder heads}

- F02F 11/005 . {involving cylinder liners}

- F02F 11/007 . {involving rotary applications}

- F02F 2001/00** **Cylinders; Cylinder heads** (in general [F16J](#))

- F02F 2001/006 . having a ring at the inside of a liner or cylinder for preventing the deposit of carbon oil

- particles, e.g. oil scrapers
- [F02F 2001/008](#) . Stress problems, especially related to thermal stress
- [F02F 2001/02](#) . having cooling means ([cylinder heads F02F 1/26](#))
- [F02F 2001/10](#) .. for liquid cooling
- [F02F 2001/104](#) ... using an open deck, i.e. the water jacket is open at the block top face
- [F02F 2001/106](#) ... using a closed deck, i.e. the water jacket is not open at the block top face
- [F02F 2001/24](#) . Cylinder heads
- [F02F 2001/241](#) .. specially adapted to pent roof shape of the combustion chamber
- [F02F 2001/244](#) .. Arrangement of valve stems in cylinder heads
- [F02F 2001/245](#) ... the valve stems being orientated at an angle with the cylinder axis
- [F02F 2001/246](#) and orientated radially from the combustion chamber surface
- [F02F 2001/247](#) ... the valve stems being orientated in parallel with the cylinder axis
- [F02F 2001/248](#) .. Methods for avoiding thermal stress-induced cracks in the zone between valve seat openings
- [F02F 2001/249](#) .. with flame plate, e.g. insert in the cylinder head used as a thermal insulation between cylinder head and combustion chamber
- [F02F 2001/42](#) .. Shape or arrangement of intake or exhaust channels in cylinder heads
- [F02F 2001/4207](#) ... Arrangements with one conduit connected with two valves; Arrangements connecting one valve with two conduits
- [F02F 2001/4264](#) ... { of exhaust channels}
- [F02F 2001/4278](#) Exhaust collectors
- [F02F 2003/00](#) **Pistons** (in general [F16J](#))
- [F02F 2003/0007](#) . Monolithic pistons; One piece constructions; Casting of pistons
- [F02F 2003/0015](#) . {Multi-part pistons}
- [F02F 2003/003](#) .. {the parts being connected by casting, brazing, welding or clamping}
- [F02F 2003/0038](#) ... by brazing
- [F02F 2003/0046](#) ... by crimping
- [F02F 2003/0053](#) ... by soldering
- [F02F 2003/0061](#) ... by welding
- [F02F 2007/00](#) **Casings, e.g. crankcases** ([engine casings in general F16M](#)){or frames}
- [F02F 2007/0021](#) . {Construction}
- [F02F 2007/0041](#) .. Fixing Bolts
- [F02F 2007/0043](#) . {Arrangements of mechanical drive elements}
- [F02F 2007/0053](#) .. {Crankshaft bearings fitted in the crankcase}
- [F02F 2007/0056](#) ... using bearing beams, i.e. bearings interconnected by a beam or multiple beams

- F02F 2007/006 . {Camshaft or pushrod housings (oil sumps [F01M 11/0004](#))}
- [F02F 2007/0063](#) .. Head bolts; Arrangements of cylinder head bolts
- F02F 2007/0065 . {Shape of casings for other machine parts and purposes, e.g. utilisation purposes, safety}
- F02F 2007/0073 .. {Adaptations for fitting the engine, e.g. front-plates or bell-housings}
- [F02F 2007/0075](#) ... Front covers
- [F02F 2007/0078](#) ... Covers for belt transmissions
- F02F 2007/0085 . {Materials for constructing engines or their parts}
- [F02F 2007/009](#) .. Hypereutectic aluminum, e.g. aluminum alloys with high SI content
- [F02F 2007/0092](#) .. Transparent materials
- [F02F 2007/0097](#) . for large diesel engines

[F02F 2200/00](#) Manufacturing

- [F02F 2200/02](#) . Riveting
- [F02F 2200/04](#) . Forging of engine parts
- [F02F 2200/06](#) . Casting ([casting of pistons F02F 2003/0007](#))
- [F02F 2200/08](#) .. using a lost model, e.g. foam casting
- [F02F 2200/11](#) . using wrought materials, e.g. wrought steels

[F02F 2547/00](#)